Final report for Vector

Forecasting key inputs to DPP reset decision for electricity distribution businesses

Analysis of potential approaches

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Contents

1 Introduction

Network Strategies Limited has undertaken a forecasting study for Vector in relation to key inputs to the default price-quality path (DPP) reset decision for electricity distribution businesses (EDBs). The objective of this project is to help determine the approaches the Commerce Commission should adopt for forecasting changes to the following two inputs for the 2015 EDB DPP reset:

- capex (capital expenditures)
- opex (operating expenditures).

Our approach to the study involved:

- identifying potential approaches to forecasting the two inputs for the 2015 reset
- testing the approaches empirically to determine how they perform
- examining the advantages and disadvantages of different approaches.

Note that Vector requested that we focus on econometric methodologies in respect to capex and opex forecasts.

This report is structured as follows:

- a review of the 2010-2015 reset (Section 2)
- an explanation of the base case models used in our analysis (Section 3)
- an examination of different methodologies for selecting key inputs (Section 4)
- an analysis of the impact on EDBs of different forecasting approaches (Section 5)
- conclusions (Section 6).

Annexed to the report is information on data sets and sources.

2 Review of 2010-2015 DPP reset

The Commerce Commission uses price-quality regulation to regulate 17 electricity distribution businesses (EDBs) under Part 4 of the Commerce Act 1986.[1] A DPP is applied to all regulated EDBs for a defined period. However an EDB can choose to apply for an alternative or customised price-quality path (CPP) depending on its circumstances. As defined by the Commission, the main components of a DPP include setting:

- starting prices (at the beginning of the regulatory period)
- the allowed annual rate of change in prices
- minimum standards for service quality.

After the passing of the Commerce Amendment Act in October 2008, the first DPP (2009-2010 DPP) was set under the new Part 4 of the Act.[2] This was followed by the 2010-2015 DPP reset which was finalised on 30 November 2012.[3] In the latter reset the Commerce Commission applied input methodologies, alternative rates of change (to reduce consumer price shocks) and claw-back (to compensate for the delay in reset).[4] In addition the Commission developed forecasts for the following four inputs:

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1 Commerce Commission, *Electricity Default Price-Quality Path*, available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/.

2 Commerce Commission, *2009-2010 Default Price-Quality Path*, available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/2009-2010-default-price-quality-path/.

3 Commerce Commission (2012), *Resetting the 2010-15 Default Price-Quality Paths for 16 Electricity Distributors*, 30 November 2012.

4 Commerce Commission, *2010-2015 Default Price-Quality Path*, available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/2010-2015-default-price-quality-path/.

- capex (capital expenditures)
- opex (operating expenditures)
- revenue growth
- input price inflation.

2.1 Capital expenditure

In the 2010-2015 DPP reset[5] the Commerce Commission developed capex forecasts for two categories – network and non-network – in constant prices. The total capex was calculated by adding the two capex values and applying the input price index. The two categories were modelled separately due to differing drivers of expenditure, effects on starting prices and availability of data.

The forecast for network capex was derived using the information supplied by the EDBs as part of the 2009/10 Asset Management Plan (AMP). The Commission decided to rely on the forecast provided by the EDBs because it believed that the EDBs were in the best position to predict their future demand as well as the costs associated with meeting that demand. However, the Commission recognised that the EDBs have incentives to bias their forecasts and suggested that it would check the accuracy for the forecast against actual values for the next reset. Although Vector proposed (in its October 2012 submission[6]) that a more recent/accurate AMP (either 2011/12 or 2010/11) should be used, the Commission decided to use the 2009/10 AMP to take into account any efficiency gains or losses that occurred relative to that period. The Commission also believed that this approach would avoid potential bias because at that time the EDBs were not aware of its plan to use the AMP forecast for the reset.

The forecast for non-network capex of each EDB was estimated by averaging its expenditure from 2007/08 to 2009/10 (in constant prices), which had been previously

5 Commerce Commission (2012), *2010-2015 Default Price-Quality Path*, available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/2010-2015-default-price-quality-path/.

6 Vector (2012), *Submission to the Commerce Commission on Revised Draft Reset of the 2010-15 Default Price-Quality Paths for Electricity Distribution Businesses*, 1 October 2012.

disclosed to the Commission. This method was chosen for two reasons: a forecast for non-network capex was not available, plus non-network capex was expected to be relatively small (compared to network capex) and similar to past values. In its October 2012 submission[7] Vector suggested that the average should also include actual values for 2011 but the Commission decided to only use the actual values obtained prior to the reset period.

Finally the total nominal capex was calculated by applying the input price index to the sum of network and non-network capex. The Commission also assumed that the capex forecast (nominal) could be used as a proxy for commissioned assets.

2.2 Operating expenditure

For the 2010-2015 DPP reset,[8] the approach used by the Commission involved the use of the re-determined input methodologies to forecast each supplier's opex. The Commission's approach consisted of estimating the impact of changes in the main drivers of opex, with the inclusion of an additional adjustment to reflect increases in insurance costs attributable to natural disasters.

According to the Commission's analysis these drivers were: network scale, partial productivity, and input prices. An adjustment was made to the previous year's opex based on changes in each of these factors according to the following formula:

$$\text{Opex}_t = \text{opex}_{t-1} \times (1 + \Delta \text{ network scale effects} - \Delta \text{ opex partial productivity} + \Delta \text{ input price})$$

The forecast was derived using the initial level of opex in the 2009/10 disclosure year as the starting point. The Commission claimed that after it had examined historic trends in suppliers' opex information, there were no reasons to believe that opex in 2009/10 was atypical or future opex will differ significantly.

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7 Vector (2012), *Submission to the Commerce Commission on Revised Draft Reset of the 2010-15 Default Price-Quality Paths for Electricity Distribution Businesses*, 1 October 2012.

8 Commerce Commission (2012), *2010-2015 Default Price-Quality Path*, available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/2010-2015-default-price-quality-path/.

In the opex formula, network scale effects account for changes in the size of the network (network length) and the number of users (installation control points, or ICPs). Historic disclosure data was used to develop econometric models which identified measures of scale, and assessed their impact on network and non-network opex. Assumptions for future changes in scale were based on historic trends in network length for each supplier, and forecasts from Statistics New Zealand were used to calculate the population for each of the areas served.

The model estimated that a 1% change in network length will result in a 0.48% change in network opex (holding the number of ICPs fixed); and similarly a 1% change in the number of ICPs will result in a 0.47% increase in network opex when holding network length fixed. For non-network opex, the modelling showed that a 1% change in the number of connections is associated with a 0.82% change in non-network opex.

Since the network scale impact is calculated separately for network and non-network opex, it is necessary to estimate the weighting to apply to each. The Commission opted to use the average proportion of these costs across the industry based on the opex data from information disclosures in 2009/10 and 2010/11. The resulting weights were 41% and 59% for network and non-network opex, respectively.

Partial productivity corresponds to the changes of opex needed to provide a given level of service. In this case the Commission assumed a 0% change caused by this factor. This assumption was derived from analysis provided by third parties on historical opex partial productivity changes for New Zealand suppliers and overseas electricity distribution suppliers.

Finally, the approach included an adjustment for insurance costs resulting from the Canterbury earthquakes and other natural disasters. For this the Commission accepted all suppliers' forecasts of insurance expenses.

2.3 Revenue growth

In the 2010-2015 reset the Commission's estimates of constant price revenue forecasts involves a separate calculation for residential users, and for industrial and commercial users. The forecast change for each type of user is then combined to provide the total estimated constant price revenue as follows:

$$(\Delta \text{ constant price revenue} \times \text{proportion of line charge revenue})_{\text{residential usage}} + (\Delta \text{ constant price revenue} \times \text{proportion of line charge revenue})_{\text{industrial and commercial usage}}$$

Residential users

The Commission models residential user revenue as a function of the number of users and the energy use per user.

The estimated change in the number of users is based on Statistics New Zealand population forecasts. The Commission matches territorial population forecasts to suppliers' operating regions. The Commission also uses supplier data from Section 53ZD information requests.

To estimate changes in energy use per user the Commission reviewed industry-wide historical trends in the most recent reset and observed little change overall. Consequently the Commission assumed zero change in energy use per residential user.

The proportion of line charge revenue from residential users is calculated using information (on different categories and shares of line charge revenue) obtained by the Commission under Section 53ZD information requests.

Industrial and commercial users

The Commission models industrial and commercial user revenue as a function of regional GDP growth. Econometric modelling is used to determine the elasticity of constant price revenue to GDP. We note that during this process the Commission examined a range of alternative model specifications using both time series and cross-sectional variation.[9] The

9 Commerce Commission (2012), *Revised Draft Reset of the 2010-15 Default Price-Quality Paths*, 21 August 2012. See Attachment G.

Commission through statistical testing identified that Vector data had a significant impact on most models' estimates, possibly due to Vector's size. This resulted in the exclusion of some Vector datapoints from the analysis.

Data for the Commission's calculations is sourced from NZIER (regional GDP growth forecasts) and from Section 53ZD information requests (proportion of line charge revenue from industrial and commercial users, together with historic information) .[10]

2.4 Input price inflation

The Commission takes into account changes in input prices in its modelling of both capex and opex. In addition the Commission's financial model for DPP reset also uses an input price inflator for revenue calculations.

In the previous reset an input price index was applied to the combined network and non-network capex amount. In the absence of detailed industry-specific information, the Commission regarded the Capital Good Price Index (CGPI) as the most reliable data source for future changes in capex input prices. Actual changes in CGPI were used in the last reset for 2009/10 and 2010/11, and an NZIER forecast of CGPI was used to project input prices for 2013 to 2015.

For the adjustment of opex to account for forecast changes in input costs the Commission used NZIER estimates of the weighted average forecasts of the changes in the all industries labour cost index (LCI), and the all industries producer price index (PPI). Actual changes in LCI and PPI were used for 2009/10 and 2010/11. The forecast LCI was given a 60% weighting and the forecast PPI 40% for the previous reset, based on Australian labour expenditure data, in the absence of New Zealand data.

The financial model used forecast changes in Consumer Price Index (CPI) for revenue calculations. The quarterly CPI inflation forecast was obtained from *Monetary Policy*

10 *Ibid*, see Attachment H.

issued by the Reserve Bank of New Zealand (RBNZ) in September 2009.[11] As the forecast was only available up to 2012, it was extended for the modelling period based on the midpoint set by RBNZ.

We note that in the last reset process the Commission rejected submissions suggesting the use of more sector-specific price indices, on the basis that all industries forecasts provide a suitable proxy for sector-specific indices, which are difficult to forecast individually.

2.5 Analysis of the reset

In this section we review the Commission's forecasts from the previous reset by comparing them with actual values from the 2011 to 2013 IDs. Exhibit 2.1 to Exhibit 2.5 explore the variation between forecast and actual for capex, opex, network length, number of connections and revenue.

Total capex projections differ significantly from actual for the period 2011 to 2013 (Exhibit 2.1). Only five EDBs out of the fifteen[12] under analysis have forecasts which differ by less than 10% from actual values – around -9% for Vector.

While the forecast for network capex was based on the 2009/10 Asset Management Plan (AMP), non-network capex is the result of averaging actual expenditure from 2007/08 to 2009/10. Since non-network capex tends to be relatively small in comparison with network capex, it would be expected that the difference is due a variation in the expected spend and/or in the input price index (CGPI) used by the Commission to obtain total capex (nominal).

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11 Reserve Bank of New Zealand (2009), *Monetary Policy Statement* available at http://www.rbnz.govt.nz/monetary_policy/monetary_policy_statement/.

12 Otago Net was excluded from the analysis because actual values for 2013 are not publically available.

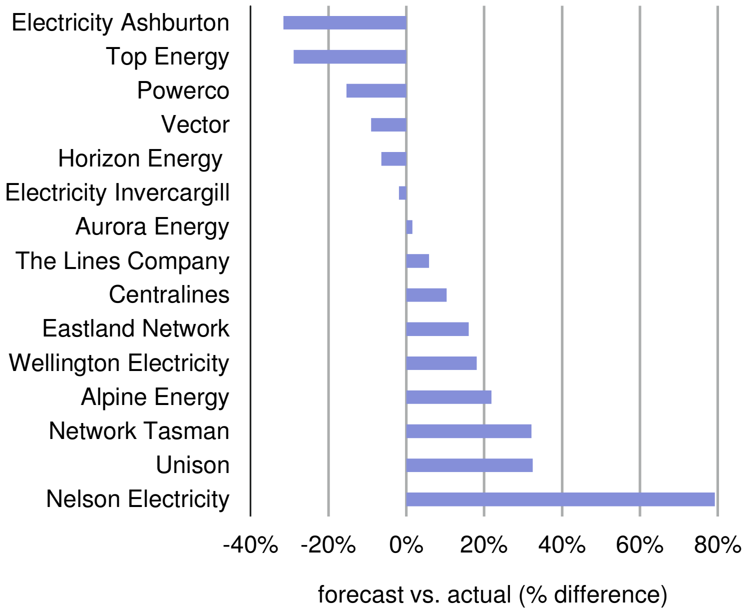

Exhibit 2.1:
Percentage difference in forecast capex compared with actual - total nominal capex for a three year period 2011-2013 [Source: Network Strategies]

In relation to actual, opex projections differ in between ±10% for most of the EDBs. However there are two outliers – Vector and Centralines – where the variation is more than ±20% (Exhibit 2.2).

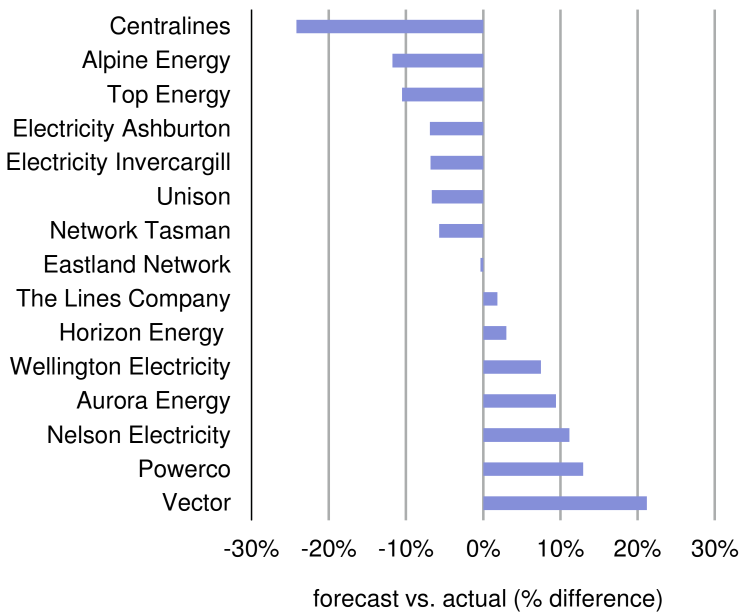

Exhibit 2.2:
Percentage difference in forecast opex compared with actual – total nominal opex for a three year period 2011-2013 [Source: Network Strategies]

The opex calculations were derived using the initial level of opex in the 2009/10 disclosure year as the starting point, and forecasting the impact of changes in the following drivers: network scale (network length and number of users), partial productivity, and input prices (LCI and PPI).

In the case of number of connections, for twelve of the fifteen EDBs the difference between forecast and actual is within ±2%, less than ±5% for the rest (Exhibit 2.3). For network length, forecasts for twelve of the EDBs differ by no more than ±5% in comparison with actual (Exhibit 2.4).

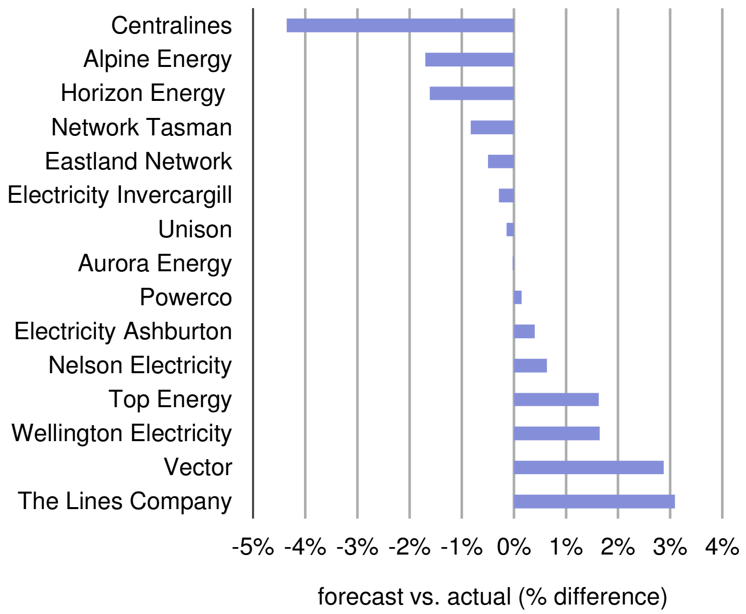

Exhibit 2.3: *Percentage difference in forecast of number of connections compared with 2013 actual [Source: Network Strategies]*

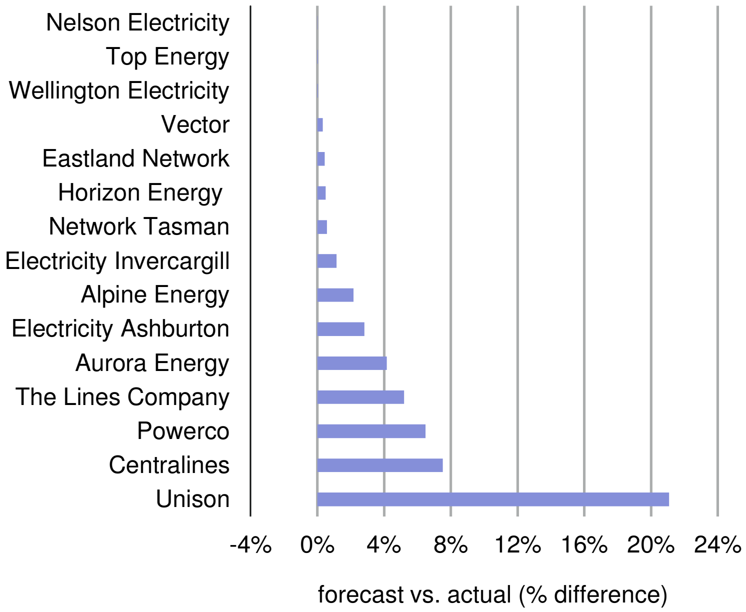

Exhibit 2.4: *Percentage difference in forecast of network length compared with 2013 actual [Source: Network Strategies]*

From the comparison of revenue projections it is found that forecasts for eleven of the fifteen EDBs are within ±5%, and forecasts for five EDBs was overestimated (Exhibit 2.5).

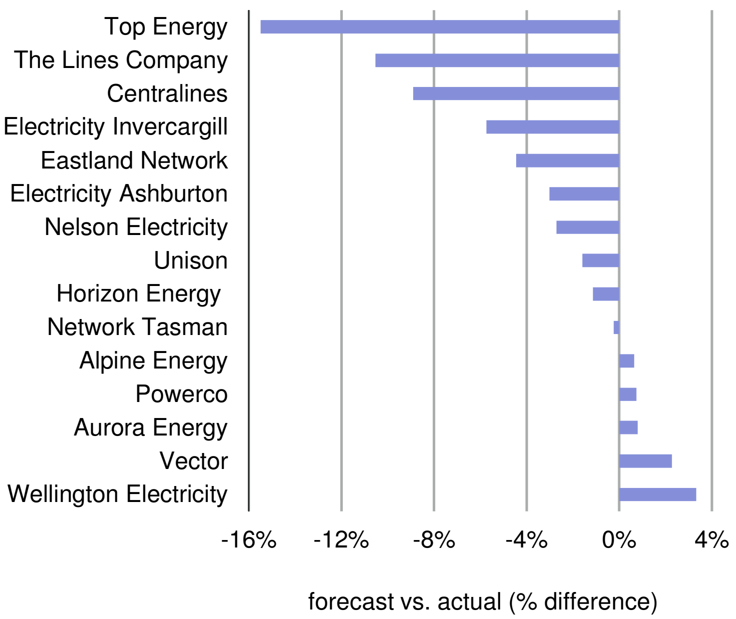

Exhibit 2.5: *Percentage difference in forecast revenue compared with actual – total nominal revenue for a three year period 2011-2013 [Source: Network Strategies]*

Forecast of revenue growth is a function of regional GDP growth and change in number of users. As shown in Exhibit 2.3 and Exhibit 2.5 there is no relationship between the results, which can indicate that the percentage difference in revenue is due to the number of connections.

3 Base case models

The Commerce Commission's approach from the 2010-2015 DPP reset is used for our base case analysis for revenue, capex and input price inflation. The models proposed by the Commission have been reviewed in the light of the revised IDs and updated with new data sets. In the case of opex the base case corresponds to the 2015-2020 forecasting model released by the Commission in 2013.[13]

3.1 Capital expenditure

In the 2010-2015 reset, the Commission relied on constant price network capex forecast disclosed by the EDBs under the 2009/10 AMPs. The Commission's forecast for non-network capex was based on average of historic values. Finally total capex was calculated by adding the two capex values and converted to nominal values using an input price inflator (CGPI). The Commission also assumed that the capex forecast could be used as a proxy for commissioned assets.

As in the previous reset, capex is estimated for two separate categories and the resultant total capex is used as a proxy for commissioned assets in the base case analysis. The forecasts for capex are based on the expenditure information disclosed by the EDBs under Schedule 11a of the 2013 IDs.[14] Unlike the older IDs, each EDB disclosed both network and non-network expenditure under the 2013 ID. Thus non-network capex is found directly

13 Commerce Commission (2013), *Summary and analysis of information disclosed in March 2013* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/summary-and-analysis-of-information-disclosed-in-march-2013/.

14 *Ibid.*

(without averaging historic data as is the case for the earlier data). The EDBs disclosed the expenditure values in both nominal and constant prices. However each EDB used its own price inflators to convert from constant price to nominal values. In order to have consistency across all EDBs, the inflator used by Vector has been applied to all EDBs' constant price capex values.

3.2 Operating expenditure

The 2015-2020 opex forecasting model[15] is used to estimate the opex forecast for base case analysis. This model uses similar assumptions to the 2010-2015 reset model (described in Section 2.2). However, unlike the previous model, the new model calculates opex separately for two categories (i.e. network and non-network) in addition to total opex. Another feature of the new model is that opex is calculated in both constant price and nominal values.

Using 2011/12 as the base year, the model estimates forecasts for network and non-network opex by making adjustments to the previous year's values. The forecasts for constant price network and non-network opex are calculated separately by considering changes in network length, number of users and partial productivity. In addition adjustments are performed to account for out of trend factors which include increases in insurance costs due to natural disasters. Finally input prices inflators (based on LCI and PPI) are used to determine nominal network and non-network opex. The total nominal opex (sum of network and non-network opex) is used as an input for the financial model.

3.3 Revenue

In the base case for revenue growth, the Commission's 2010-2015 DPP reset model is used. To date the Commission has not given any indication that this approach is under review, hence it was assumed that the same model will be used to calculate revenue growth for the period 2015-2020.

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15 *Ibid.*

As was described in Section 2.3 the approach involves modelling constant price revenue separately for residential users, and industrial and commercial users. Revenue from residential users is calculated as a function of the change in number of residential users and energy use per residential user. Revenue from industrial and commercial users is modelled as a function of change in real GDP. Both forecasts are then combined based on assumed shares of total revenue among residential and industrial/commercial users to provide total revenue growth results.

Line charge revenue residential and total revenue values are used to calculate the percentage share of total revenue from residential and from industrial/commercial users. The model was updated with values from the IDs released in August 2013, only for those EDBs for which information was available – ten EDBs.[16] For the rest of the EDBs the same 2011 values from the previous reset model were used for the base case.[17]

The 2015-2020 opex forecasting model released by the Commission[18] contains forecasts of percentage change in the number of residential users which, as in the previous reset, was calculated using population forecasts from Statistics New Zealand as a proxy. These values were used as an input for the revenue growth base case.

In regards to the change in electricity use per residential user and elasticity of constant price revenue to GDP, for the base case the same assumptions as for the previous reset were adopted (Section 2.3).

Revenue from a charge based on electricity delivered and distribution line charge revenue are inputs to the model for calculating share of revenue Since the revenue breakdown from the 2013 IDs differs among EDBs it is not possible to clearly identify the required inputs, hence values for the base case correspond to those used in the previous reset. In any event,

16 The following seven EDBs did not include residential revenue figures in their 2013 IDs: Alpine Energy, Electricity Ashburton, Nelson Electricity, Network Tasman, OtagoNet, Powerco, and The Lines Company.

17 Line charge revenue residential and total revenue are used to calculate percentage shares of total revenue that is from residential users and from industrial/commercial users. It is assumed that these percentages will not change significantly from 2011 to 2013.

18 Commerce Commission (2013), *Summary and analysis of information disclosed in March 2013* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/summary-and-analysis-of-information-disclosed-in-march-2013/.

as the Commission assumes 0% change in electricity use per residential user there is no effect on the final results.

Change in real GDP is a function of forecast of regional GDP growth and energy used by Grid Exit Point (GXP), and as for the previous reset updated figures were sourced from NZIER and the Electricity Authority (EA) respectively. Forecasts of annual average percent change in regional GDP (from 2015 to 2020) were sourced from NZIER's quarterly predictions and GXP electricity volumes for 2013 (offtake in GWh) were taken from EA's centralised dataset.

3.4 Input price inflation

As discussed in Section 2.4, CGPI, LCI, PPI and CPI were the indices used for input price inflation in the 2010-2015 reset. CGPI forecast was considered for future changes in capex input prices whereas weighted average forecasts of the changes in LCI and PPI were applied for opex. CPI was used for revenue inflation in the financial model.

In our base case analysis, Vector's inflator[19] is used for converting constant price capex values provided by the EDBs to nominal values. Similar to the 2010-2015 reset, the Commission's 2015-2020 opex forecasting model[20] applies updated NZIER forecasts for LCI and PPI.

For the CPI forecast, the Commission's approach in the 2010-2015 reset has been extended. Hence quarterly CPI inflation forecast was obtained from the March 2014 Monetary Policy Statement[21] issued by RBNZ for the available quarters (i.e. up to March 2017). For the quarters beyond March 2017, CPI inflation is assumed to have an equal

19 The inflator is derived from Schedule 11a of Vector's 2013 ID submission.

20 Commerce Commission (2013), *Summary and analysis of information disclosed in March 2013* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/summary-and-analysis-of-information-disclosed-in-march-2013/.

21 Reserve Bank of New Zealand (2014), *Monetary Policy Statement* available at http://www.rbnz.govt.nz/monetary_policy/monetary_policy_statement/.

increment/decrement each year for three years (i.e. up to March 2020) so that inflation in the last year is equal to the target midpoint set out in RBNZ's Monetary Policy Statement.[22]

3.5 Financial analysis

The preliminary financial model[23] released by the Commission in December 2013 for 2015-2020 reset was used for our base case analysis. The model is an updated version of the 2010-2015 reset financial model, with generally the same core elements and some changes to the layout and presentation.[24]

There are several inputs required for the 2015-2020 reset model which can be broadly categorised as either general or EDB specific inputs. The general inputs (which are the same for all EDBs) are forecast changes in CPI, tax rate forecast, Vanilla WACC, cost of debt, leverage and industry-wide X factor. The changes in CPI used for revaluations and price path are calculated from the RBNZ's inflation forecast (as described in Section 3.4). The industry-wide X factor is assumed to be zero (which is same as the 2010-2015 reset). The other general inputs are obtained from the 2013 cost of capital determination[25] used for CPP.

The EDB specific inputs consist of initial conditions and forecasts. Most of the initial conditions are based on the RAB, regulatory tax allowance and Term Credit Spread Differential (TCSD) values disclosed by the EDBs in Schedules 4, 5a and 5c of the IDs

22 Reserve Bank of New Zealand (2014), *Monetary Policy Statement March 2014* available at http://www.rbnz.govt.nz/monetary_policy/monetary_policy_statement/2014/MPSmar14.pdf.

23 Commerce Commission (2013), *Default Price-Quality Path from 2015* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/default-price-quality-path-from-2015/.

24 Commerce Commission (2013), *Preliminary version of the financial model for electricity default price-quality paths from 2015: Technical consultation* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/default-price-quality-path-from-2015/.

25 Commerce Commission (2013), *Cost of capital determination for electricity distribution businesses to apply to a customised price-quality path proposal [2013] NZCC 16* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/information-disclosed-in-august-2013/.

released in August 2013[26]. The other initial conditions – additional allowance and alternative X-factor – are assumed to be zero for all the EDBs.

The EDB specific forecasts for commissioned assets, opex and revenue are obtained using the approaches described in Sections 3.1, 3.2 and 3.3 respectively. In addition there are two more forecasts – value of disposed assets and other regulatory income – required as inputs to the model. Their values are found from Schedules 3 and 4 of the August 2013 IDs[27] and assumed to remain constant over the modelling period.

26 Commerce Commission (2013), *Information disclosed in August 2013* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/information-disclosed-in-august-2013/.

27 *Ibid.*

4 Methodologies for forecasting key inputs

We explored the use of econometric models for capex and opex, expanding upon the earlier work conducted by the Commission. However, there are two key differences in the data used in our analysis:

- data sets include an additional two years – 2011/12 and 2012/13
- all financial data is expressed in constant 2013 prices.

Similar to the Commission, we included data from 2009/10 onwards, omitting earlier years.

Note that there are some gaps in the data – in particular for 2012/13 – where the EDBs did not supply information in the IDs. These have been treated as missing data within the econometric analysis – we have not extrapolated this information from previous years.

4.1 Capital expenditure

In our econometric modelling of capex, good results were obtained for total capex and network capex. This was to some degree expected, as network capex forms the major part of total capex.

Finding a good model was more difficult for non-network capex – this is much smaller in magnitude than network capex and the data exhibited extreme variation, or lumpiness.

We also noted some potential problems with the disaggregation into network and non-network capex. In some years several EDBs provided only network capex data, with zero non-network capex.[28] In the analysis, we used the given network capex, but treated non-network capex as missing rather than zero. In some years the non-network capex data was negative[29] – these were also treated as missing values, for both network and non-network capex.[30]

No capex data was provided by Orion NZ in 2010/11 and Otago Net in 2012/13, and these were treated as missing values.

A number of different variables were investigated within the econometric analysis, including:

- network length for supply – in km
- electricity supplied to ICPs – in GWh
- ICPs per km of circuit
- overhead circuits as a proportion of total circuits – with value between zero and 1
- opex
- SAIDI (System Average Interruption Duration Index)
- SAIFI (System Average Interruption Frequency Index)
- distribution transformer capacity (EDB owned) – in MVA ('transformer capacity')
- maximum coincident system demand – in MV
- population
- earthquake dummy – taking a value of 1 in all years after the Christchurch earthquake and zero otherwise, to denote a potential step change in costs
- national GDP – in constant 2013 dollars
- exempt status – with a value of 1 for exempt EDBs and zero otherwise
- linear trend factor – to represent an underlying trend in capex not accounted for in the other explanatory variables.

28 EDBs providing zero non-network capex were Aurora Energy for 2009/10 to 2012/13, Buller Electricity for 2012/13, Otago Net for 2009/10 and West Power for 2009/10, 2010/11 and 2012/13

29 Counties Power in 2011/12 and Top Energy in 2009/10.

30 Inclusion of the network capex data for these two EDBs had very little effect on the model results.

All the models used a log-linear functional form, with the log of either network or non-network capex being the predicted variable.

One of our findings in the analysis was that national GDP was not statistically significant, for either network or non-network capex.

Network capital expenditure

The econometric analysis produced several suitable models for network capex (Exhibit 4.1). Note the negative sign for the overhead proportion variable – a higher proportion of overhead circuits results in lower capex.

	Model 1	*Model 2*	*Model 3*
Model parameters			
ln(network length for supply)	0.723***		
ln(electricity supplied to ICPs)	0.337**		
ln(ICPs per km circuit)		-0.185***	-0.381***
Overhead proportion	-0.828**		-0.569
SAIDI		0.001***	0.001***
ln(transformer capacity)		1.034***	1.047***
Constant	8.745***	10.326***	11.139***
Model diagnostics			
Adjusted R^2	0.87	0.88	0.88
F statistic	244	275	210
N	112	112	112

*** – significant at the 1% level.

Exhibit 4.1: *Comparison of model parameters and diagnostics – network capital expenditure [Source: Network Strategies]*

It should be noted that maximum coincident system demand was not statistically significant. Also the inclusion of transformer capacity within the models resulted in network length no longer being statistically significant.

As all models had excellent fit, we did not believe it was necessary to omit any potential outliers from the analysis. However as forecasts for transformer capacity are not available, model 1 would be preferred for forecasting purposes.[31]

Non-network capital expenditure

As noted above, identifying a robust model for non-network capex proved to be difficult. We believe the main reasons for this are the considerable variation in spend from year to year, coupled with data problems. Nonetheless, we were able to identify several models that may be suitable for forecasting (Exhibit 4.2).

	Model 1	*Model 2*	*Model 3*
Model parameters			
ln(non-network opex)	1.499***		
ln(electricity supplied to ICPs)		0.720***	0.403***
ln(non-network capex, lag 1)		0.425***	0.653***
Constant	-10.269***	2.992***	2.027***
Model diagnostics			
Adjusted R^2	0.58	0.54	0.70
F statistic	142	57	104
N	103	97	91

*** – significant at the 1% level.

Exhibit 4.2: *Comparison of model parameters and diagnostics – non-network capital expenditure [Source: Network Strategies]*

One of the parameters in Model 1 is non-network opex. We note that in the absence of opex data, business modellers commonly assume that opex is a percentage of cumulative capex, and thus identifying such a relationship in the econometric model is not surprising.

31 Although EDBs' projections for network length are not available, forecasts for use in model 1 are obtainable from the 2015-2020 opex model released by the Commission in 2013.

Ideally however a capex model should encapsulate appropriate drivers which should differ from those of opex, and so this is not our preferred model.

Model 2 identifies a relationship with non-network capex from the preceding year, namely non-network capex lagged by one year. All the variables are statistically significant, however there is considerable variation within the data that is not explained by the model. We then greatly improved the model fit by omitting a small number of outliers from the analysis, resulting in model 3. The omitted datapoints, all of which differ greatly from non-network capex for the EDB in other years, were:

- Eastland Networks – 2012/13
- Electricity Ashburton – 2012/2013
- OtagoNet – 2011/12
- Waipa Networks – 2010/11 and 2011/12
- Wellington Electricity – 2009/10.

We were unable to identify a suitable model that included neither lagged non-network capex nor non-network opex.

Model 3 is our preferred model. Due to the use of the lagged term in this model, any resultant forecasts would be relatively smooth, that is the forecasts would not capture the year-to-year variation inherent in non-network capex.

Total capital expenditure

As well as investigating the network and non-network disaggregation of capex, we also explored models of total capex. The results were similar to those for network capex, due to total capex being dominated by this component.

Given the problems in the disaggregated data (discussed above) plus the increased error inherent in adding two separate forecasts, we would recommend using models based on total capex, rather than models for both network and non-network capex, especially given the good fit of the total capex models (Exhibit 4.3).

	Model 1	*Model 2*	*Model 3*	*Model 4*
Model parameters				
ln(network length for supply)	0.687***			
ln(electricity supplied to ICPs)	0.382***			
ln(ICPs per km circuit)		-0.446***	-0.503***	-0.732***
Overhead proportion	-0.799***	-0.878***		-0.659
SAIDI		0.001***		
ln(transformer capacity)		1.088***	0.733***	0.739***
Exempt status		0.151		
ln(population)			0.376***	0.385***
Constant	8.793***	11.275***	8.900***	9.785***
Model diagnostics				
Adjusted R^2	0.86	0.88	0.88	0.88
F statistic	234	172	282	217
N	114	114	114	114

*** – significant at the 1% level.

Exhibit 4.3: *Comparison of model parameters and diagnostics – total capital expenditture [Source: Network Strategies]*

Network length was only statistically significant if transformer capacity was not also included within the model. Maximum coincident system demand was not statistically significant. Due to the good fit of the models, we did not consider it necessary to omit any outlying values.

In terms of the model diagnostics, there is little to distinguish between the models, however we note that forecasts of transformer capacity are not available, so for forecasting purposes, model 1 must be the preferred option.

4.2 Operating expenditure

Utilising the functional form of the Commission's earlier models for both network and non-network opex, we obtained excellent fits to the revised data set. We consider both model forms to be satisfactory for use in forecasting.

However, we also examined the inclusion of additional parameters, namely:

- electricity supplied to ICPs, in km (for network opex – previously included in the Commission's model for non-network opex)
- ICPs per km of circuit (for network opex – previously included in the Commission's model for non-network opex)
- population
- population density
- earthquake dummy – taking a value of 1 in all years after the Christchurch earthquake and zero otherwise, to denote a potential step change in costs
- national GDP – in constant 2013 prices
- linear trend factor – to represent an underlying trend in opex not accounted for in the other explanatory variables.

All the models used a log-linear functional form, with the log of either network or non-network opex being the predicted variable.

Given the excellent fit of the models tested, we did not believe it was necessary to omit any potential outliers from the analysis. Opex data for Orion in 2010/11 and OtagoNet in 2012/13 was not included in the IDs and were thus treated as missing values within the analysis.

Network operating expenditure

While the functional form used by the Commission (Model 1 in Exhibit 4.4) provides an excellent fit to the data, several variations of the model utilising additional parameters (Models 2 to 4 in Exhibit 4.4) gave a slightly superior fit. All the parameters were statistically significant at the 1% level. Other parameters did not prove successful.

	Model 1	*Model 2*	*Model 3*	*Model 4*
Model parameters				
ln(network length for supply)	0.942***	0.656***	0.962***	0.920***
ln(ICPs per km circuit)			0.447***	
ln(population)		0.338***		
ln(population density)				0.155***
Constant	7.565***	6.124***	6.364***	7.375***
Model diagnostics				
Adjusted R^2	0.81	0.89	0.89	0.87
F statistic	488	445	443	367
N	114	114	114	114

Model 1 is the functional form used by the Commission.

*** – significant at the 1% level.

Exhibit 4.4: *Comparison of model parameters and diagnostics – network operating expenditure [Source: Network Strategies]*

Any of these models would be suitable for forecasting purposes, however we note that the use of ICPs per km circuit would require forecasts for that variable.

Non-network operating expenditure

The functional form used by the Commission for non-network opex still provided a good fit to the data, although we noted that the parameter electricity supplied to the ICPs is no longer statistically significant (Model 1 in Exhibit 4.5).

	Model 1	*Model 2*	*Model 3*
Model parameters			
ln(network length for supply)	0.628***	0.325***	0.809***
ln(electricity supplied to ICPs)	0.179		
ln(ICPs per km)	0.531***		0.680***
ln(population)		0.537***	
Trend		0.068***	0.061**
Constant	8.088***	6.838***	7.306***
Model diagnostics			
Adjusted R^2	0.88	0.91	0.89
F statistic	286	364	294
N	114	114	114

Model 1 is the functional form used by the Commission.

*** – significant at the 1% level.

** – significant at the 5% level

Exhibit 4.5: *Comparison of model parameters and diagnostics – non-network operating expenditure [Source: Network Strategies]*

Based on the model diagnostics there is very little evidence on which to distinguish between the models – all would be suitable for use in forecasting. All the parameters in models 2 and 3 are statistically significant, and as discussed above the availability of population forecasts is an advantage when the inclusion of population parameters reduces the need for forecasts of other parameters. Model 2 (noting that network opex will require forecasts of network length) is therefore considered to be the preferred model.

Note that very similar models can be obtained if the linear trend parameter is replaced by the log of GDP. Over the time span of the data set, GDP exhibits a steady upward trend, and so the analysis may have just identified the significance of this trend. Confirming a relationship with GDP would require a longer timeframe.

We note that Frontier Economics recommended that Buller Electricity and Nelson Electricity be omitted from the analysis for all years, not just the year in which the data was flagged as being an outlier. Our econometric analysis, most likely due to the differing parameters used, did not identify these EDBs as being outliers. Our model parameters – in particular those relating to population – may provide a better explanation of the behaviour observed for these EDBs (other than any unusual circumstances noted by Frontier).

In addition, the dataset used by Frontier Economics (prior to trimming) contained only 55 observations, and so the additional datapoints incorporated in our analysis enabled us to explain the opex behaviour of these two EDBs.

Furthermore, the models produced by Frontier's trimmed dataset were quite similar to those for the full dataset, with the parameters in most instances only varying by a small amount. It is therefore likely that the resultant forecasts of the trimmed and untrimmed models would be well within the bounds of the model standard error (not reported by Frontier Economics).

5 Results: base case versus alternatives

The use of alternative methodologies for forecasting inputs is likely to have an impact on EDB's allowable revenues for the regulatory period. In this Section we compare EDBs' allowable revenues under the base case with those obtained from the use of individual alternative methodologies, and combinations of alternative methodologies.

5.1 Capital expenditure

A comparison of the total capex values (2014-2020) obtained from the base case and econometric models is shown in Exhibit 5.1. Projections from the econometric model differ significantly from the base case. Seven of the sixteen EDBs[32] under analysis have forecasts which differ by within ±10% from the base case results.

32 Otago Net was excluded from the analysis because actual values for 2013 are not publicly available.

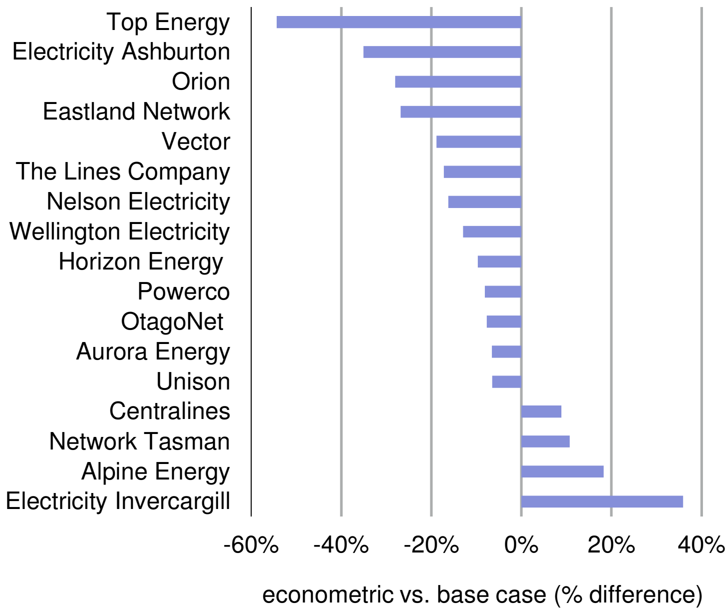

Exhibit 5.1: *Percentage difference in total capex forecasts (nominal) obtained from econometric and base case models (2014-2020) [Source: Network Strategies]*

5.2 Operating expenditure

In the case of opex, total opex values (2014-2020) obtained from the base case and econometric models vary significantly (Exhibit 5.2). Projections differ by more than 15% for most of the EDBs. Only one EDB's forecast differs by less than ±10% – Alpine Energy.

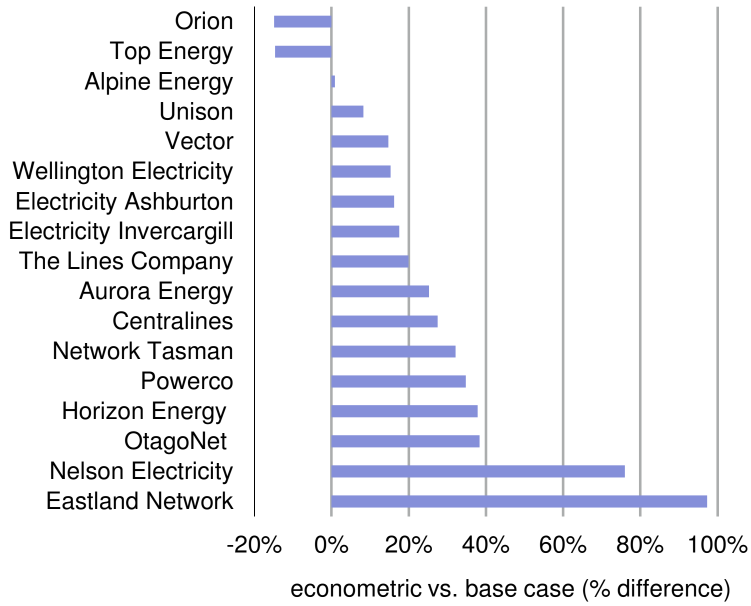

Exhibit 5.2: *Percentage difference in total opex forecasts (nominal) obtained from econometric and base case models (2014-2020) [Source: Network Strategies]*

5.3 Financial model allowable revenue

Four scenarios with varying capex and opex inputs are considered to investigate the impact on EDBs (Exhibit 5.3). Base case models (discussed in Section 3) are used for all the inputs in Scenario 1. Scenario 1 is modified by obtaining capex and opex from econometric analysis for Scenarios 2 and 3 respectively. Finally in Scenario 4 both opex and capex inputs are found using econometric models.

Scenario	*Capex*	*Opex*
Scenario 1	Base case	Base case
Scenario 2	Econometrics	Base case
Scenario 3	Base case	Econometrics
Scenario 4	Econometrics	Econometrics

Exhibit 5.3: *Methodologies used to forecast financial model inputs for the scenarios [Source: Network Strategies]*

The present value (PV) at 1 April 2015 for building blocks allowable revenue (BBAR) for each EDB is calculated for the four scenarios using the financial model (discussed in Section 3.5). The percentage differences in results for Scenarios 2, 3 and 4 (compared to Scenario 1) are shown in Exhibit 5.4, Exhibit 5.5, and Exhibit 5.6.

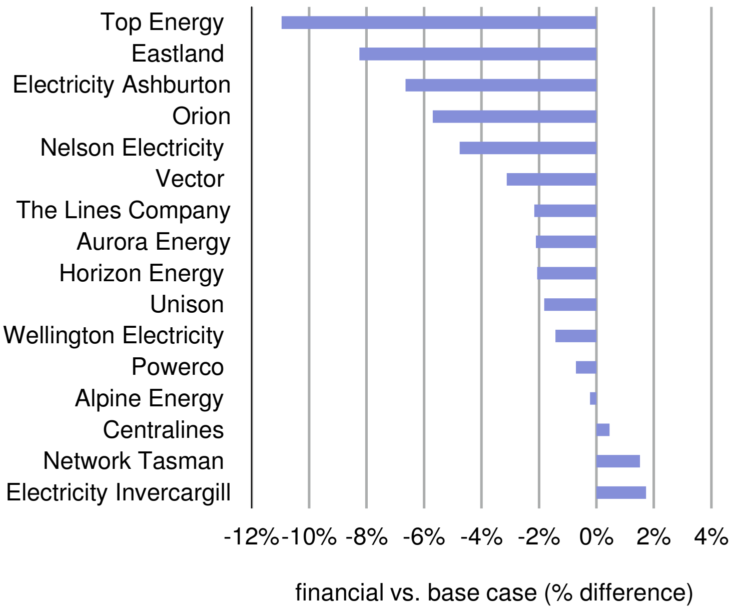

Exhibit 5.4: *Scenario 2 results – percentage difference in BBAR (PV at 1 April 2015) compared to Scenario 1 [Source: Network Strategies]*

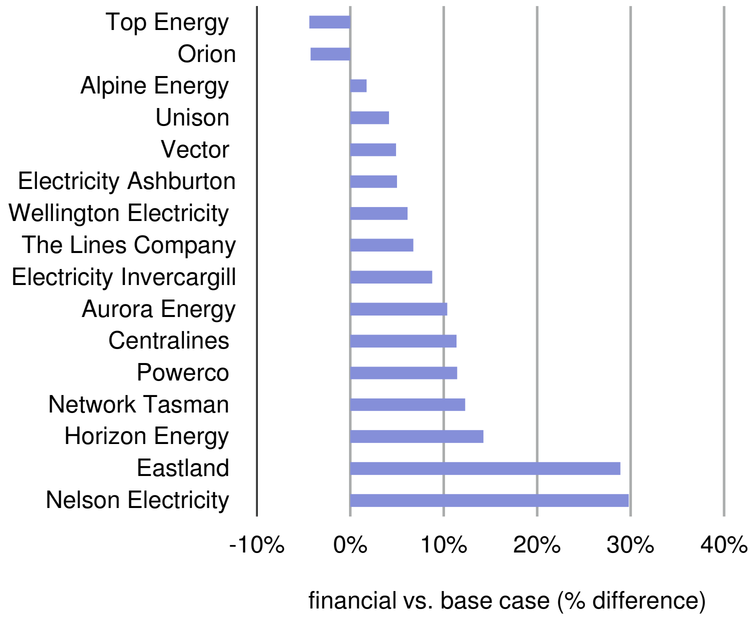

Exhibit 5.5: *Scenario 3 results – percentage difference in BBAR (PV at 1 April 2015) compared to Scenario 1 [Source: Network Strategies]*

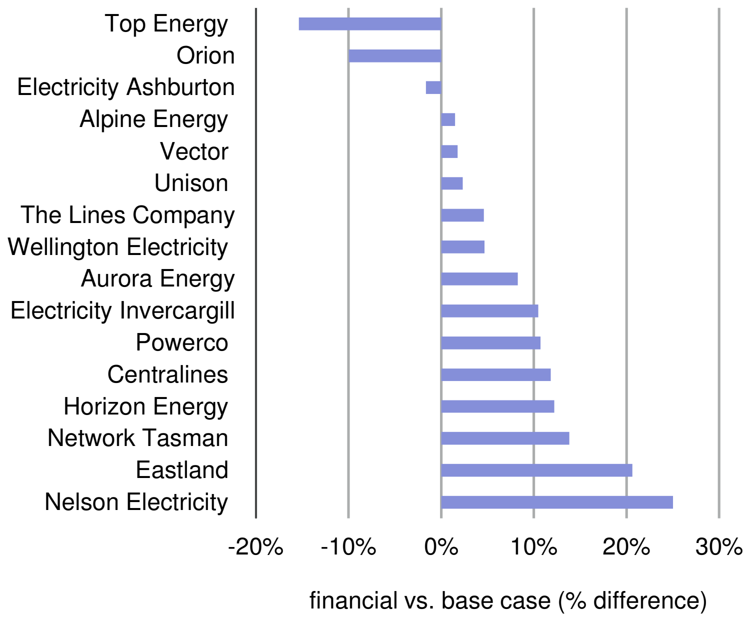

Exhibit 5.6: *Scenario 4 results – percentage difference in BBAR (PV at 1 April 2015) compared to Scenario 1 [Source: Network Strategies]*

6 Conclusions

The analysis that produced the models is, by its nature, a composite view based on information from all EDBs. With limited regional data – both actual and forecast – it proved problematic to encapsulate regional drivers within the econometric models. Furthermore, the data spans only four years. This timeframe is insufficient to establish clearly the presence of any underlying trends, such as increasing energy efficiency. Furthermore, this also means that forecasting error will increase and may become quite high for the medium to long term (that is, beyond two years in the future).

All of the models produced in our analysis must be considered satisfactory for forecasting purposes. The best models, in terms of fit and performance, are summarised in Exhibit 6.1.

Input	*Best model*
Capex	
Total capex	Model 1
Opex	
Network opex	Model 3
Non-network opex	Model 2

***Exhibit 6.1**: Best econometric models [Source: Network Strategies]*

In the course of our analysis, it became evident that there are a number of clear differences between Vector and the other EDBs. Vector is the largest of all the EDBs and its Auckland market – in terms of scale, diversity, customer mix and geography – is unique within New Zealand. National economic and demographic characteristics are heavily influenced by Auckland, however as each of the EDBs are given equal weighting within the analysis, the models may not deliver an outcome that is a best fit for Vector's unique situation.

It is important to note that a fundamental assumption that underpins this type of econometric modelling is that any relationships that hold for past data will continue to apply in the future. The models do not allow for a situation in which new factors may become significant drivers of costs and revenues, or changes in the relationships between existing drivers and costs and revenues.

So while a model may perform very well against past data, there is no certainty that it will continue to do so. It is therefore important to monitor and assess model performance over time.

Annex A: Data sets and sources

A collection of updated and extended data sets was required to support the modelling and analysis. The information includes the data used by the Commission for the previous reset, and data that have become available since that time.

When the required information was not available, or the results of data assessment were not acceptable, Network Strategies performed additional calculations and/or used alternative sources for completing the data set.

A.1 EDB information

Companies' information (i.e. opex, capex, revenue, asset, demand, and network factors) was sourced mostly from EDBs' information disclosures (ID) available at the Commerce Commission's website[33] (Exhibit A.1 and Exhibit A.2). Under subpart 9 of Part 4 of the Commerce Act 1986, EDBs are subject to information disclosure regulation and the Commerce Commission is required to publish a summary and analysis of these releases.

Actual values from 2008 to 2012 were collected from a Commerce Commission database published in March 2013[34] which encompasses EDBs' disclosures from these years. Actual values for 2013 are from the latest IDs released on August 2013.[35]

33 Commerce Commission (2014), *Electricity Information Disclosure* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/

34 Commerce Commission (2013), *Summary and analysis of information disclosed in March 2013* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/summary-and-analysis-of-information-disclosed-in-march-2013/.

As part of the IDs, EDBs release Asset Management Plans (AMP). The AMP is a ten-year plan which contains details of network assets, planned network developments, future maintenance needs and forecast expenditures. Forecasts for years 2014 to 2023 correspond with the AMPs published by the Commerce Commission in March 2013.[36] The dataset also includes the Commerce Commission 2014-2023 forecasts for Opex, included as part of the same disclosure.[37]

Our analysis requires all the information to be converted to constant prices 2013 (year ending 31 March). For those cases where only nominal values or real prices with a different base year were available additional calculations were performed to convert values into 2013 constant prices.

When information was available in constant prices but with a different base year than 2013, conversions were made using the respective nominal values. Firstly, a deflator index was calculated for each of the years as the relation between nominal and real prices. The deflator was then referenced to year 2013 and used to adjust nominal prices to obtain constant prices.

Electricity demand by Grid Exit Point (GXP) is an input for forecasting GDP growth by EDB. As for the previous reset GXP electricity volumes for 2013 were sourced from the Electricity Authority's (EA) centralised dataset.[38]

35 Commerce Commission (2013), *Information disclosed in August 2013* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/information-disclosed-in-august-2013/.

36 Commerce Commission (2013), *Summary and analysis of information disclosed in March 2013* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/summary-and-analysis-of-information-disclosed-in-march-2013/.

37 *Ibid.*

38 Electricity Authority (2014), *Electricity Demand By GXP* available at http://www.ea.govt.nz/industry/monitoring/cds/centralised-dataset-web-interface/electricity-demand-by-gxp/

	Actual/Forecast	*Source*
Revenue (nominal prices)		
Total[2]	2008-2013	March and August 2013 IDs
Total minus pass-through and transmission costs[1]	2008-2013	March and August 2013 IDs
Capex (constant prices 2013)		
Total	2008-2013/2014-2023	March and August 2013 IDs
Non-network	2008-2013/2014-2023	March and August 2013 IDs
Network	2008-2013/2014-2023	March and August 2013 IDs
customer connection	2008-2013/2014-2023	March and August 2013 IDs
system growth	2008-2013/2014-2023	March and August 2013 IDs
reliability, safety and environment	2008-2013/2014-2023	March and August 2013 IDs
asset replacement and renewal	2008-2013/2014-2023	March and August 2013 IDs
asset relocations	2008-2013/2014-2023	March and August 2013 IDs
Opex (constant prices 2013)		
Non-network	2008-2013 / 2014-2023	March and August 2013 IDs
Network	2008-2013 / 2014-2023	March and August 2013 IDs
Initial conditions in the financial model – RAB, regulatory tax allowance and TCSD	2013	August 2013 IDs

1 For all connections.

2 For all connections and breakdown by connection type: small, medium, large and largest 5 connections.

***Exhibit A.1**:* *Revenue, Capex and Opex [Source: Network Strategies Limited]*

	Actual/Forecast	*Source*
Network		
Network length for supply (km)	2008-2013 / 2014-2020	March and August 2013 IDs. Network Strategies' calculations for 2014-2020.
Overhead network length (km)	2008-2013	March and August 2013 IDs. Network Strategies' calculations for 2014-2020.
Percentage of circuit that is overhead	2008-2013	Network Strategies' calculations.
Distribution transformer capacity - EDB Owned (MVA)	2008-2013	March and August 2013 IDs.
SAIFI - total	2008-2013 / 2014-2018	March and August 2013 IDs. Network Strategies' calculations for 2013.
SAIDI - total	2008-2013 / 2014-2018	March and August 2013 IDs. Network Strategies' calculations for 2013.
Demand		
Number of Connection Points (ICPs)	2008-2013 / 2014-2020	March and August 2013 IDs. Network Strategies' calculations for 2019-2020.
Electricity supplied to ICPs (GWh)	2008-2013 / 2014-2020	March and August 2013 IDs. Network Strategies' calculations for 2019-2020.
ICPs per km of circuit (ICP/km)	2008-2013 / 2014-2020	March and August 2013 IDs. Network Strategies' calculations for 2014-2020.
Electricity demand by GXP (GWh)	2013	EA centralised dataset
Maximum system demand (MW)	2008-2013 / 2014-2018	March and August 2013 IDs.

Exhibit A.2*:* *Demand and network [Source: Network Strategies Limited]*

A.2 Economic indicators

In the 2010-2015 DPP reset[39] economic indicators such as Labour Cost Index (LCI), Producer Price Index (PPI), Capital Goods Price Index (CGPI), and Regional Gross

[39] Commerce Commission (2012), *2010-2015 Default Price-Quality Path*, available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/2010-2015-default-price-quality-path/.

Domestic Product (GDP) were provided by the New Zealand Institute of Economic Research (NZIER) (Exhibit A.3). We anticipate that the Commerce Commission will use the same source for the upcoming reset.

The Opex 2015-2020 forecasting model released by the Commission as part of the summary and analysis of IDs[40] contains NZIER's LCI and PPI forecast for years 2010 to 2023. Since the Commission is not licensed to publish NZIER forecasts, only a quarterly weighted average index was released. These values were included as part of the data set.

Network Strategies used some NZIER quarterly predictions for economic indicators, including regional GDP. Annual average percent change in GDP by region (constant prices) was included in the data set. Other regional GDP figures were also sourced from NZIER but since inconsistencies were found when assessing them against national GDP values, they were not considered. GDP forecasts from the New Zealand Treasury were also included as part of the data set.[41]

Actual values for Capital Goods Price Index (CGPI) and Constant Price Index (CPI) were also sourced from Statistics New Zealand. CPI forecasts from 2014 to 2016 are from the Reserve Bank of New Zealand (RBNZ). We also considered a set of additional forecasts for CPI from alternative sources – i.e. International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD), NZ Treasury, Westpac and the Australia and New Zealand Banking Group (ANZ).

Vanilla WACC, tax rates, cost of debt, leverage and industry-wide X factor are all inputs for the preliminary financial model[42] for the 2015-2020 reset. This information was sourced from the 2013 cost of capital determination[43] used for CPP.

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40 Commerce Commission (2013), *Summary and analysis of information disclosed in March 2013* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/summary-and-analysis-of-information-disclosed-in-march-2013/

41 The New Zealand Treasury (2013), *Half Year Economic and Fiscal Update – 17 December 2013*, avaible at http://www.treasury.govt.nz/budget/forecasts/hyefu2013

42 Commerce Commission (2012), *Default Price-Quality Path from 2015* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/default-price-quality-path-from-2015/.

	Actual/Forecast	*Source*
Quarterly LCI – weighted average Index	2010-2023[1]	NZIER's forecast from Commission's Opex 2015-2020 model.
Quarterly PPI – weighted average Index	2010-2023[1]	NZIER's forecast from Commission's Opex 2015-2020 model.
National GDP - constant prices 2013	2008-2013 / 2014-2020	Network Strategies' calculations based on SNZ's GDP product measure figures and real GDP growth forecast from the New Zealand Treasury.
National GDP per capita - constant prices 2013	2008-2013 / 2014-2020	Network Strategies' calculations based on SNZ's GDP product measure figures and real GDP growth forecast from the New Zealand Treasury.
Regional GDP - constant prices 2013	2008-2013 / 2014-2020	Network Strategies' calculations based on SNZ and NZIER figures
Regional GDP per capita - constant prices 2013	2008-2013 / 2014-2020	Network Strategies' calculations based on SNZ and NZIER figures
Percentage change in real GDP - regional	2007-2012 / 2013-2032	NZIER's quarterly predictions.

Exhibit A.3: *Economic factors [Source: Network Strategies Limited]*

43 Commerce Commission (2013), *Cost of capital determination for electricity distribution businesses to apply to a customised price-quality path proposal [2013] NZCC 16* available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-information-disclosure/electricity-information-disclosure-summary-and-analysis/information-disclosed-in-august-2013/.

	Actual/Forecast	Source
Annual average % change in real GDP – production measure	2013 / 2014-2018	Half year economic and fiscal update – New Zealand Treasury.
CGPI - constant prices 2013	2008-2013	Network Strategies' calculations based on SNZ's CGPI all groups figures
CPI	2008-2013 / 2014-2023	Network Strategies' calculations based on SNZ's CPI all groups and RBNZ's figures. Alternative sources available.
Company tax rate	2013 / 2014-2020	CPP - Commerce Commission
Vanilla WACC	2013	CPP - Commerce Commission
Cost of debt	2013	CPP - Commerce Commission
Leverage	2013	CPP - Commerce Commission
Industry-wide X factor	2013	CPP - Commerce Commission

1 Values were stated as forecasts

***Exhibit A.3 (cont)**:Economic factors [Source: Network Strategies Limited]*

A.3 Demographic information

As in the 2010-2015 DPP reset, demographic data from Statistics New Zealand was used for calculating population for the area covered by each of the EDBs – projections by territorial authorities 2006 (base) to 2031.[44] Calculations used in the previous reset were extended to obtain results for the time period under analysis (2015-2020).

44 Statistics New Zealand (2014), *Population projections,* available at http://nzdotstat.stats.govt.nz/wbos/.